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(54) MULTI CONDITION TAKEOFF IN CONSTRUCTION PROJECT SOFTWARE PROGRAMS

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(51) **Int. Cl.**

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G06F 17/50	(2006.01)
G06Q 10/06	(2012.01)
G06F 17/24	(2006.01)
G06Q 50/08	(2012.01)

(52) **U.S. Cl.**

CPC ***G06F 17/5004*** (2013.01); ***G06F 17/243*** (2013.01); ***G06Q 10/06*** (2013.01); ***G06Q 10/06313*** (2013.01); ***G06Q 50/08*** (2013.01)

(58) **Field of Classification Search**

None

See application file for complete search history.

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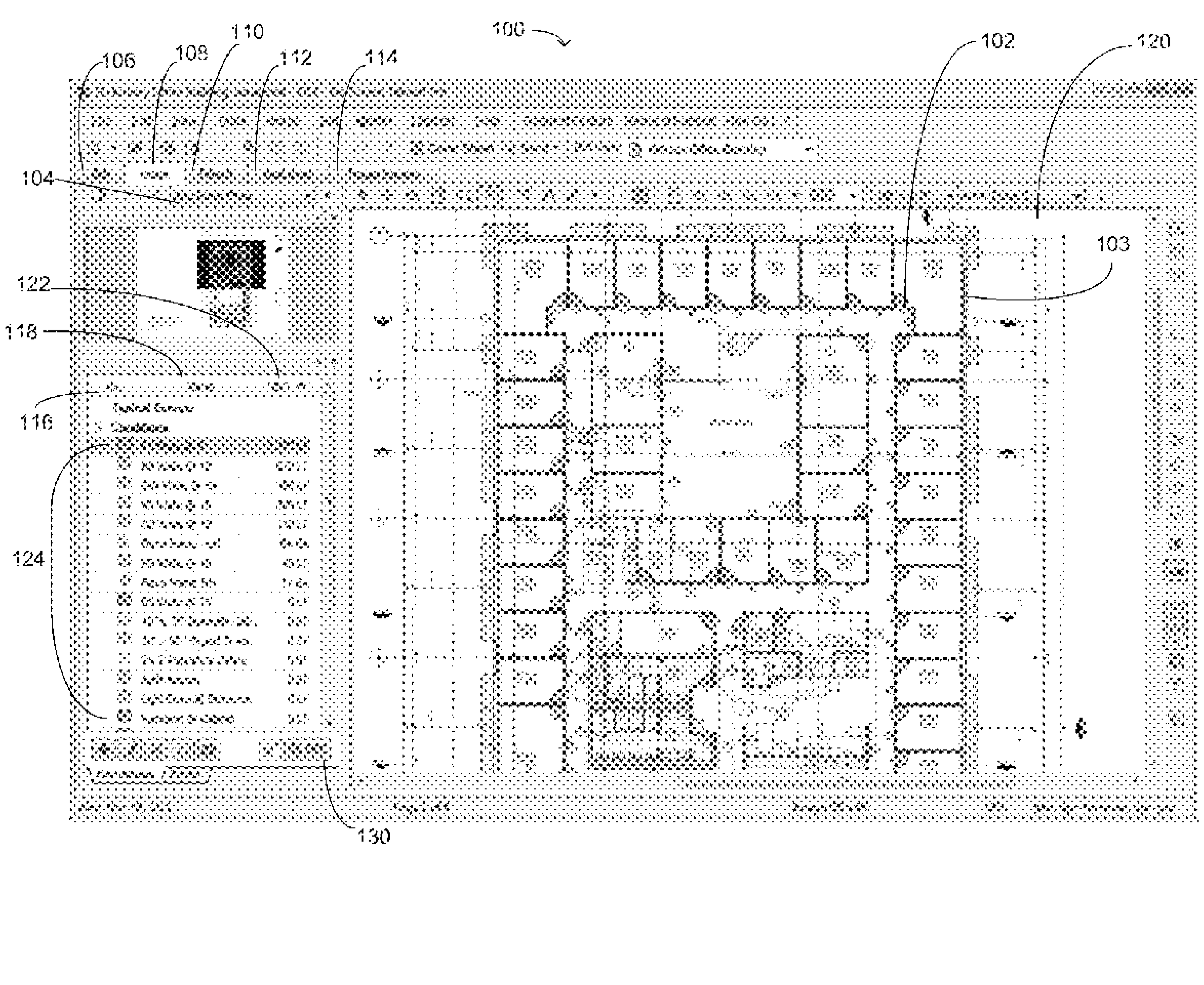
(57) **ABSTRACT**

A method and system for simultaneously performing takeoff of multiple building conditions in a construction project software program is disclosed. The method comprises selecting two or more building conditions and moving a pointer to a construction drawing to select an area to perform takeoff of the multiple building conditions on. Once the area has been selected, the method and system automatically creates one or more live objects on the selected area for each of the selected building conditions and simultaneously quantifies each of the selected building conditions based on the size of the selected area.

18 Claims, 9 Drawing Sheets



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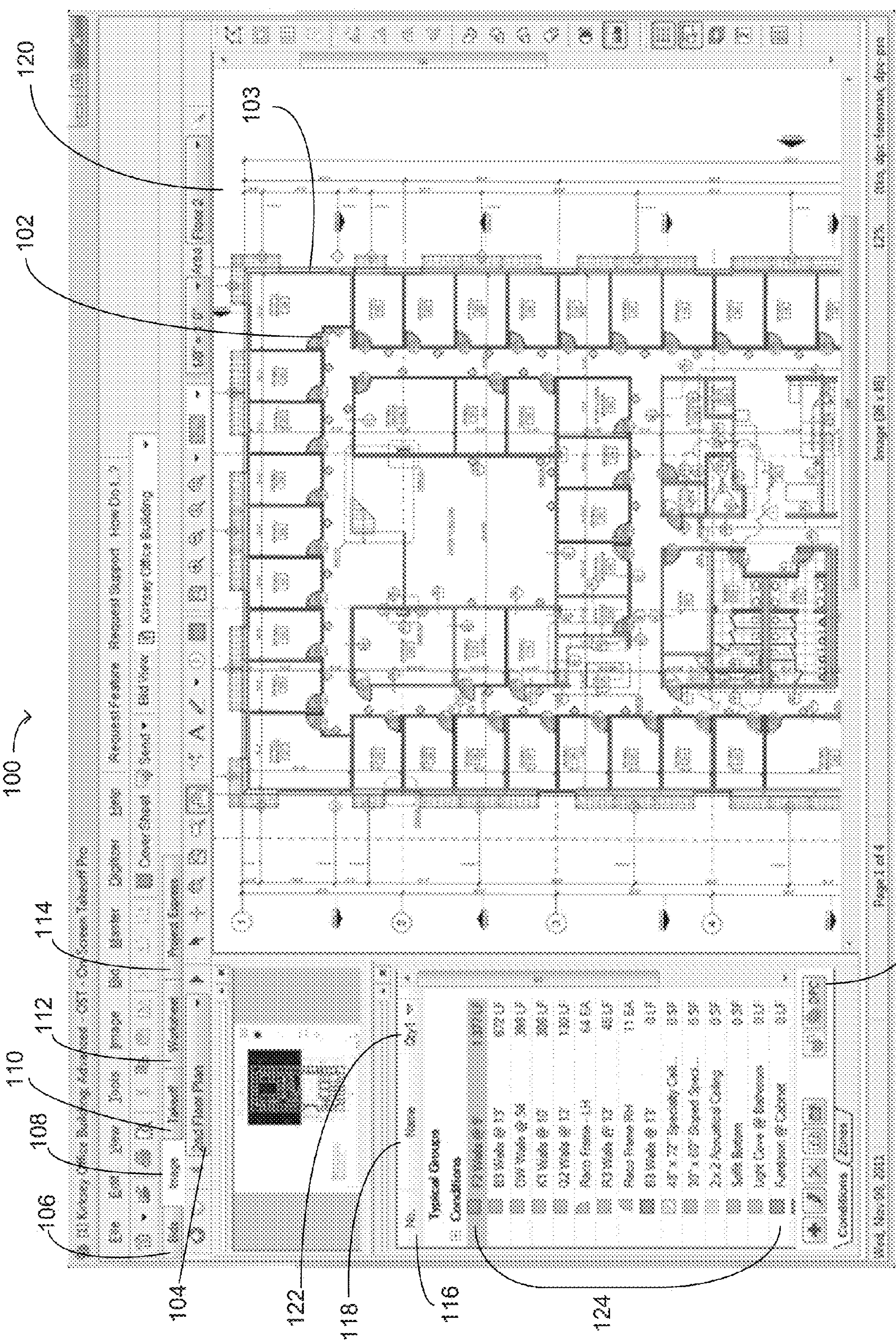


FIG. 1

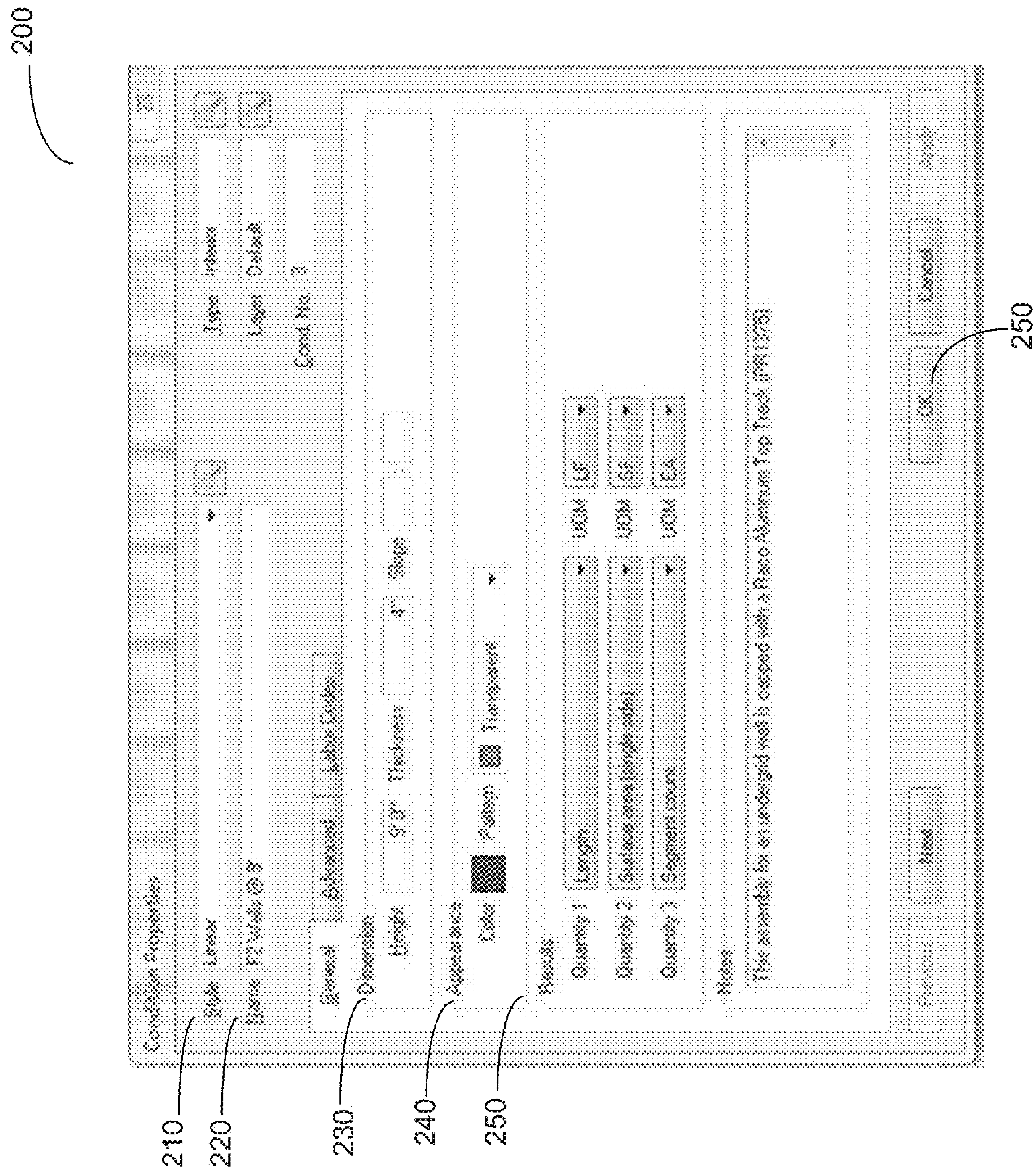


FIG. 2A

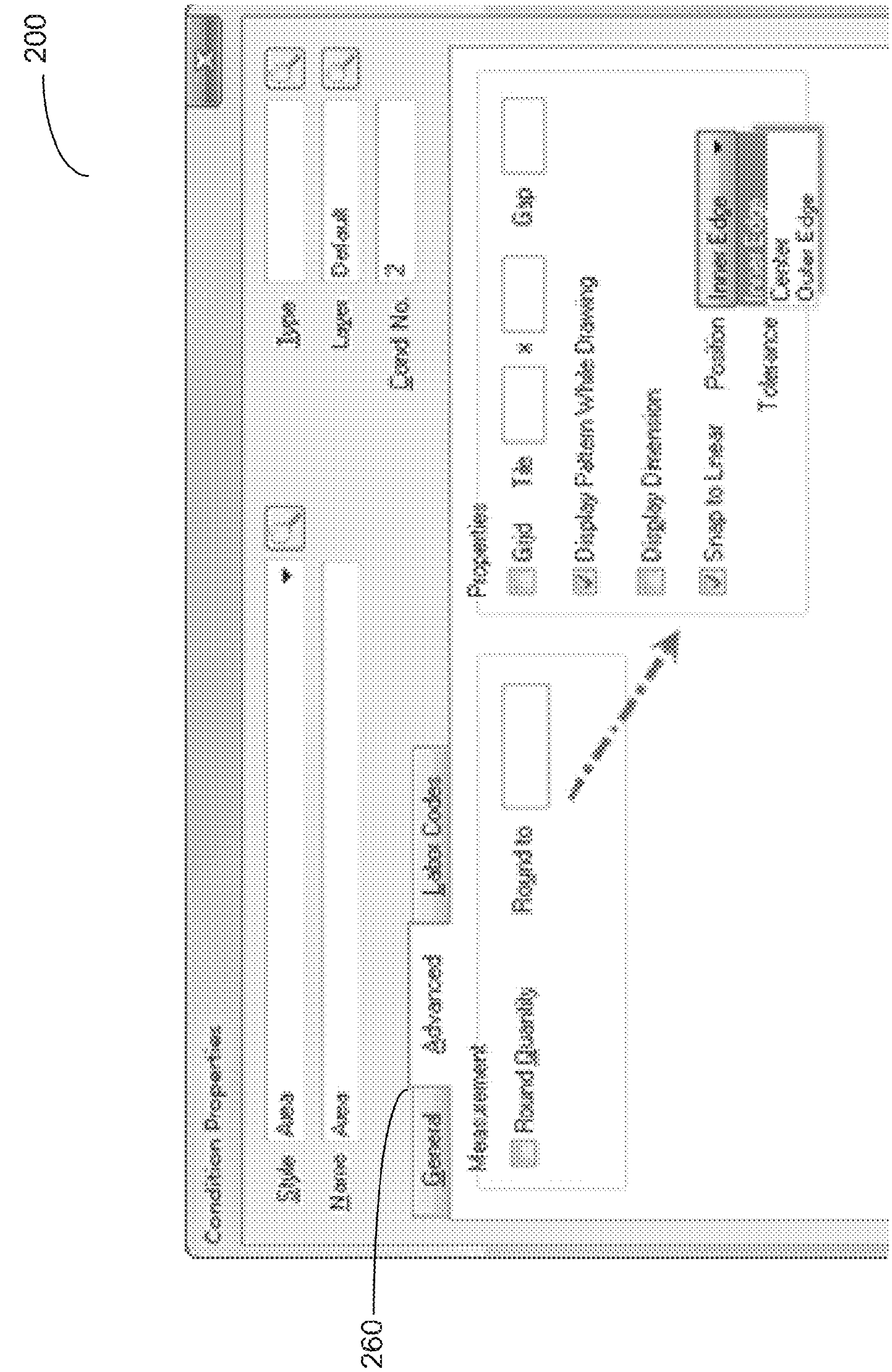

200
Condition Properties
Style Area
Name Area
Type
Layer Default
Cond No. 2
General
Advanced
Labor Codes
Measurement
Round Quantity
Round to
Properties
Grid
Tile
x
Gap
Display Pattern While Drawing
Display Dimension
Snap to Linear
Position
Inner Edge
Center
Outer Edge
Tolerance
260

FIG. 2B

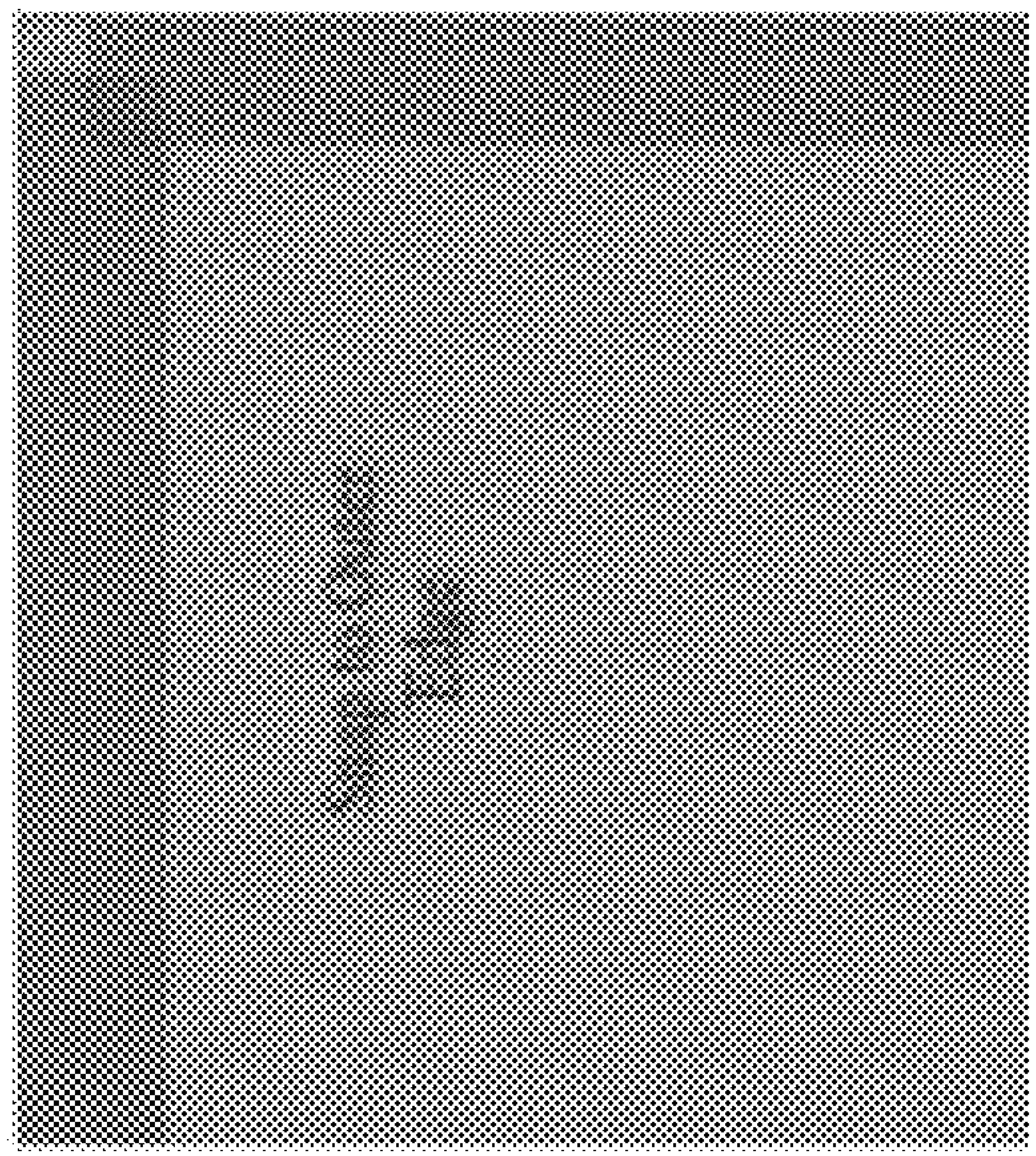


FIG. 2E

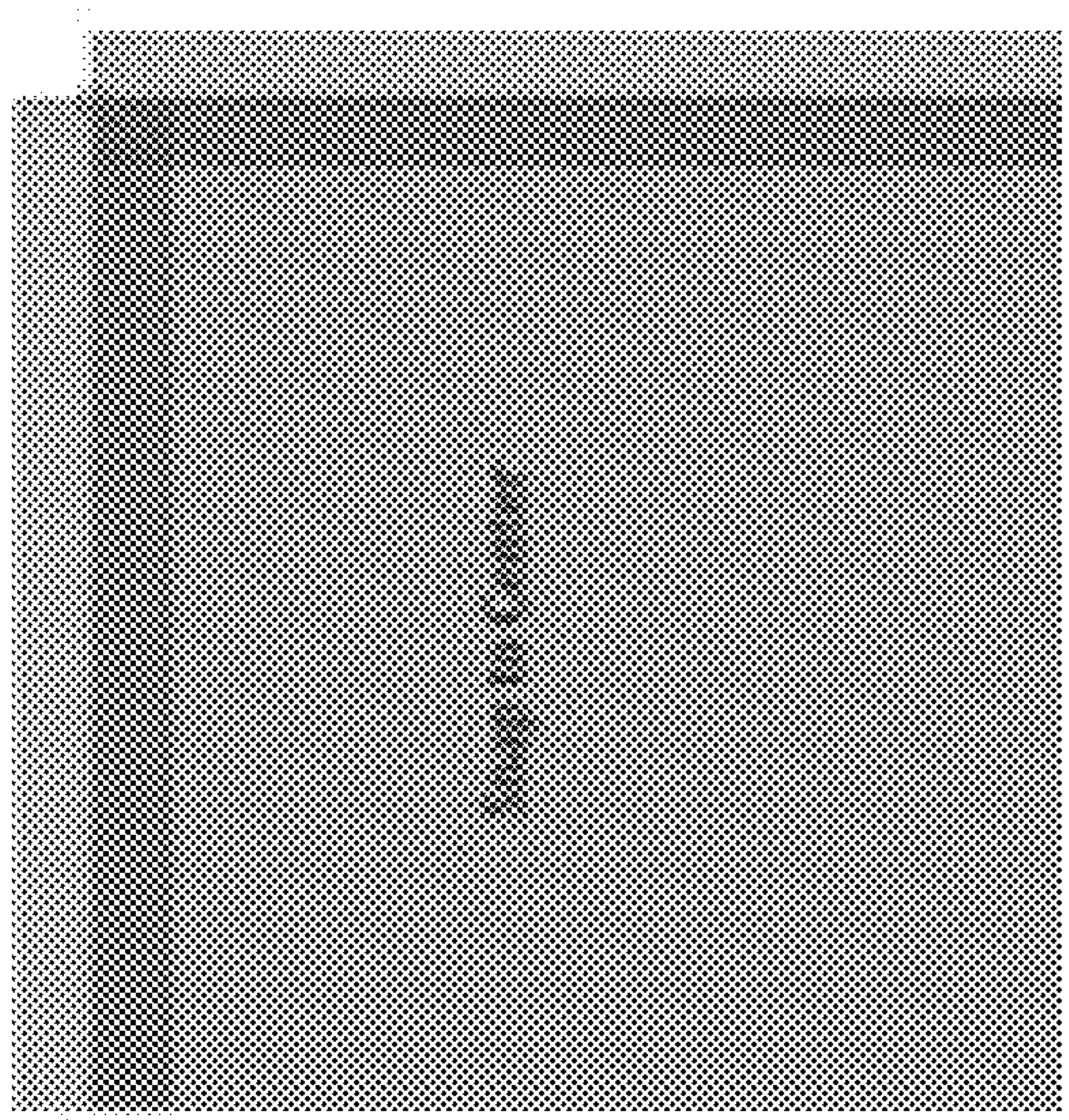


FIG. 2D

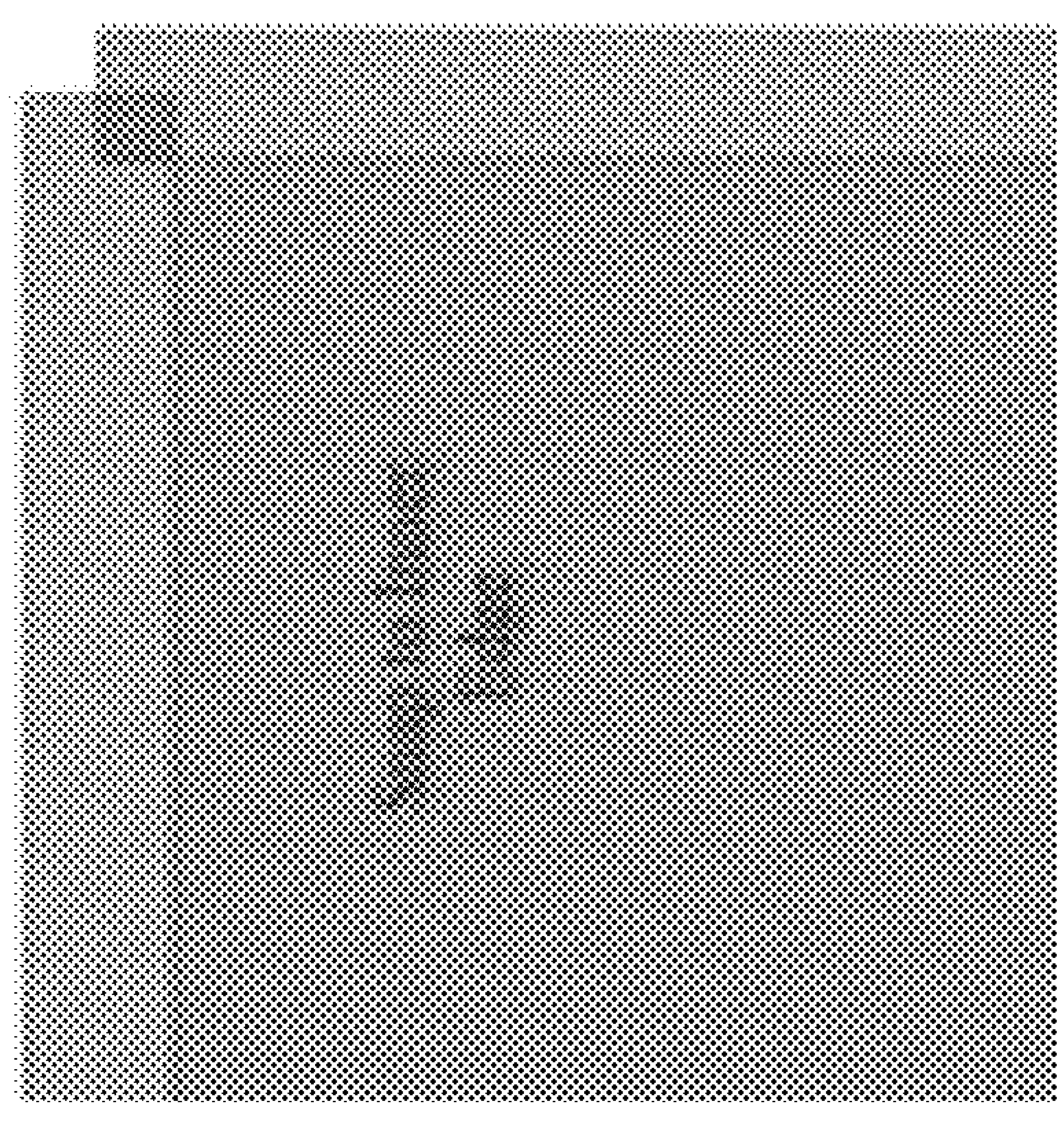
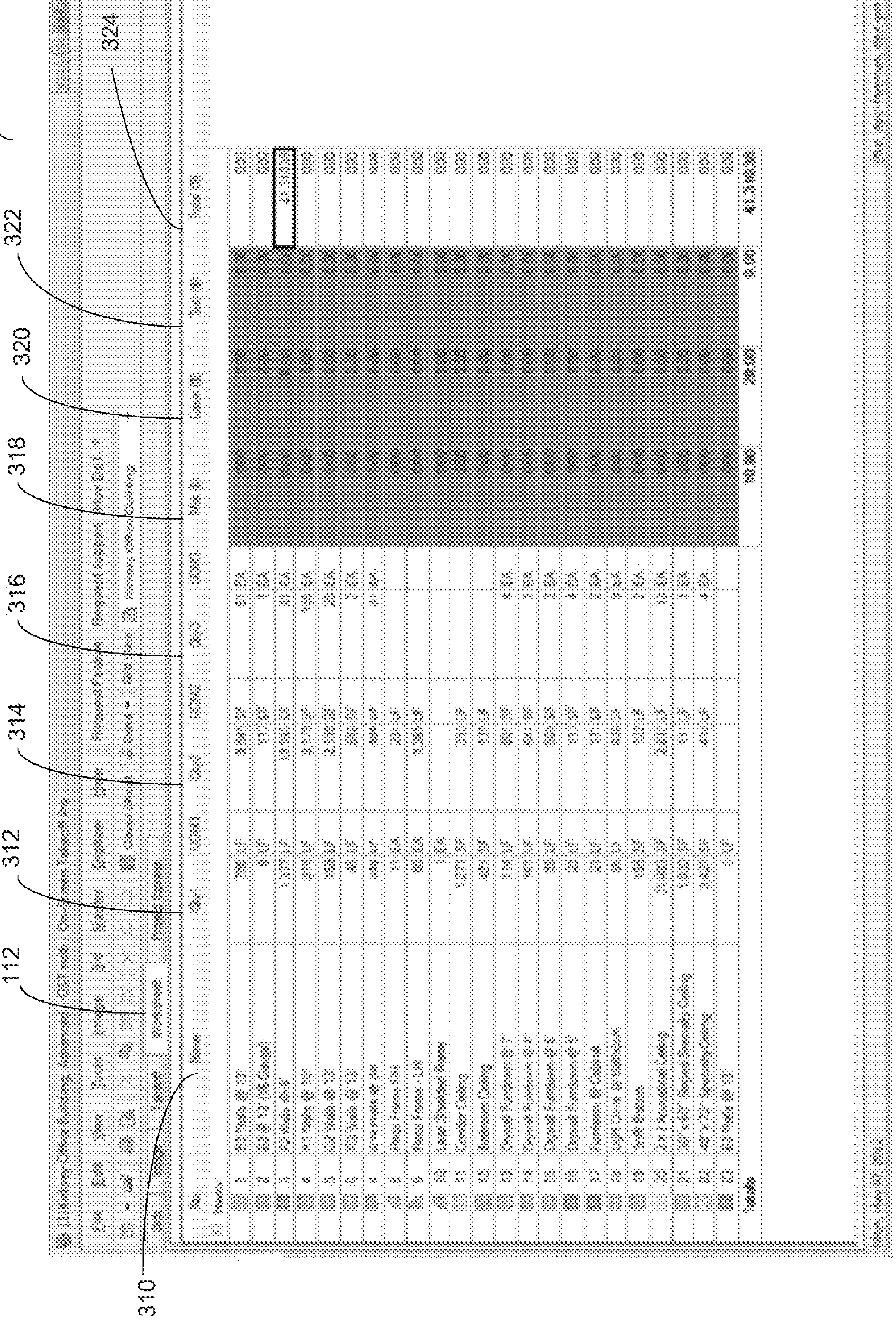


FIG. 2C

FIG. 3



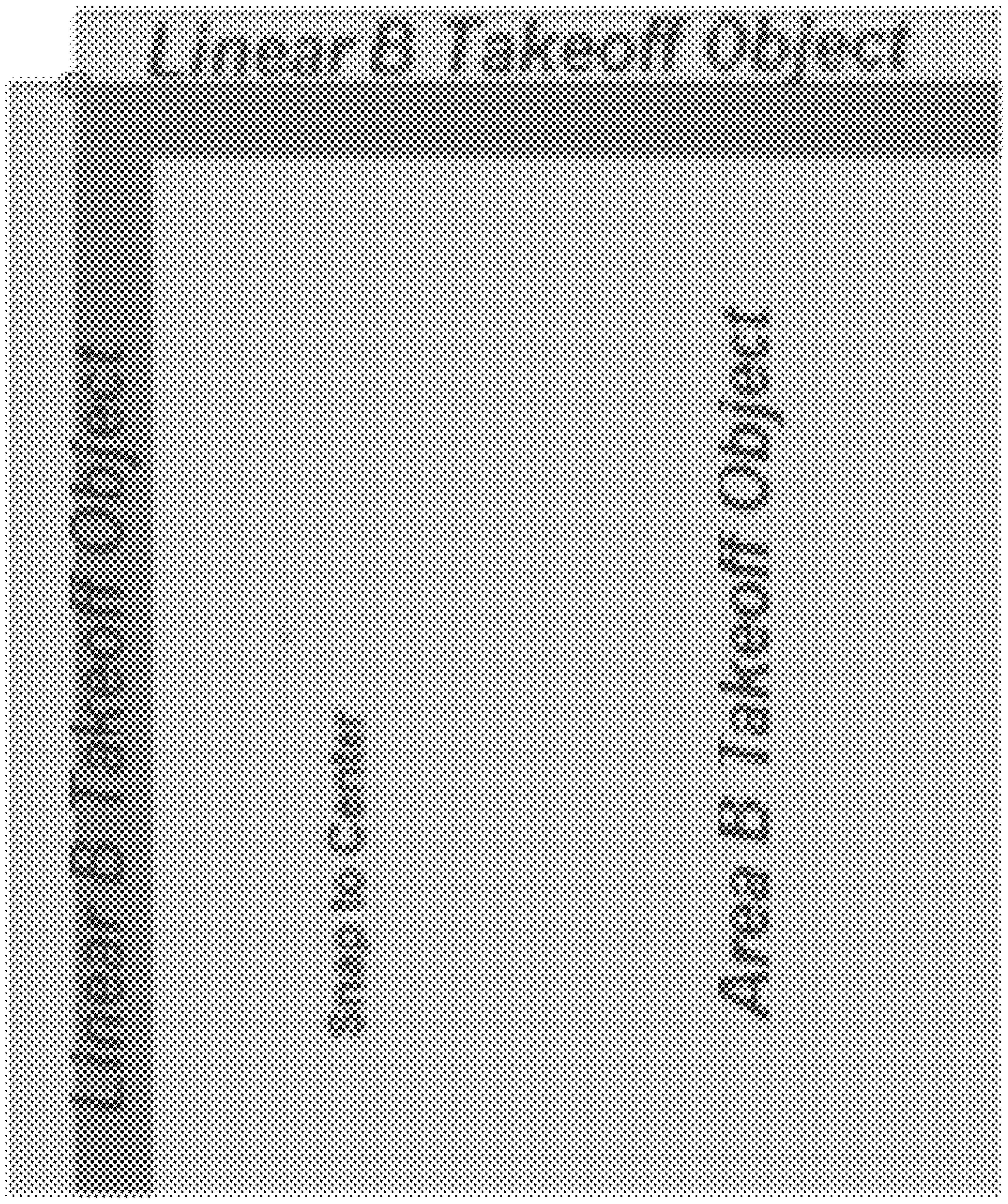

Linear B Takeoff Object
Linear B Takeoff Object
Snap to Center
Area B Takeoff Object

FIG. 4B

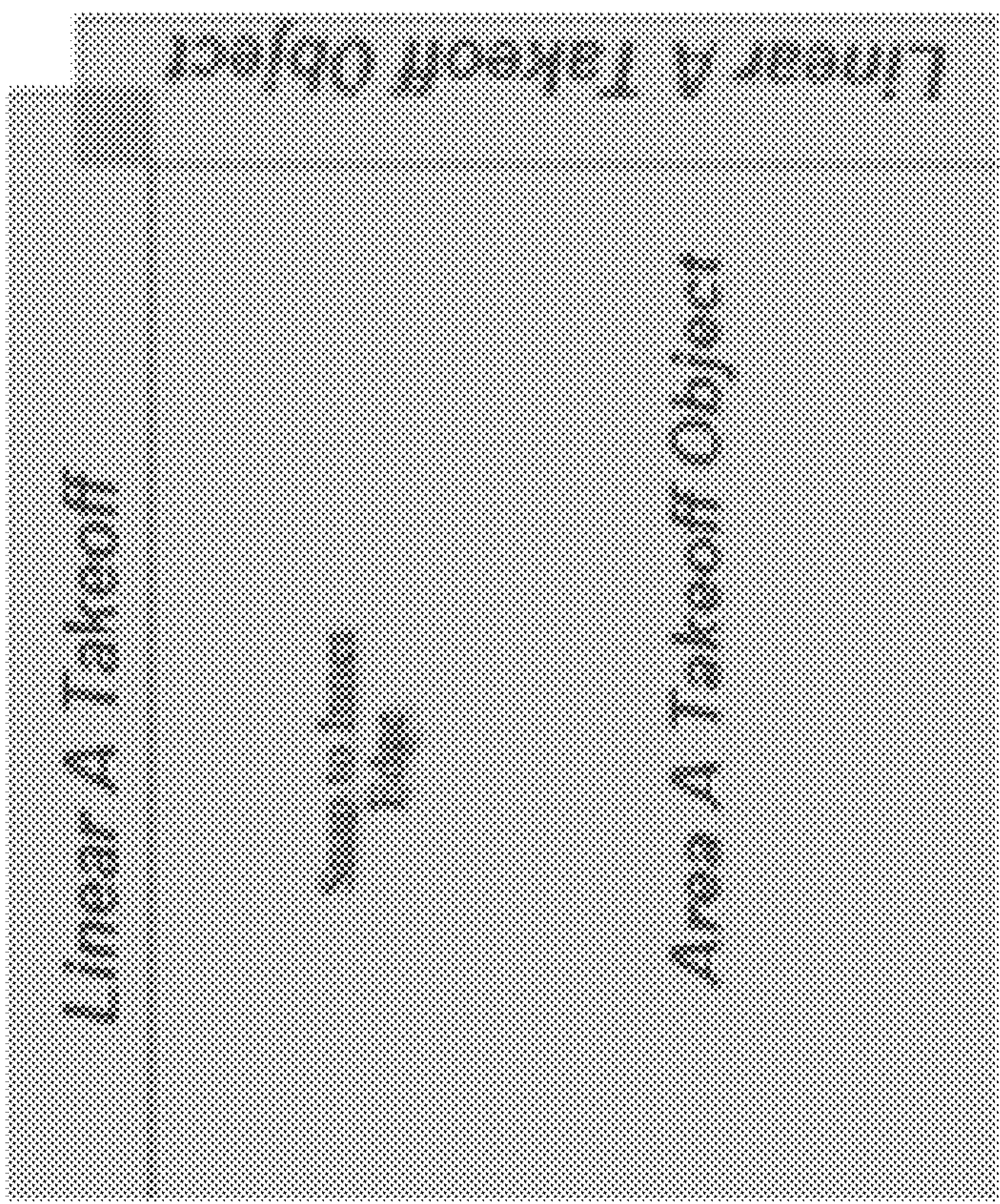

Linear A Takeoff Object
Linear A Takeoff
Area A Takeoff Object

FIG. 4A

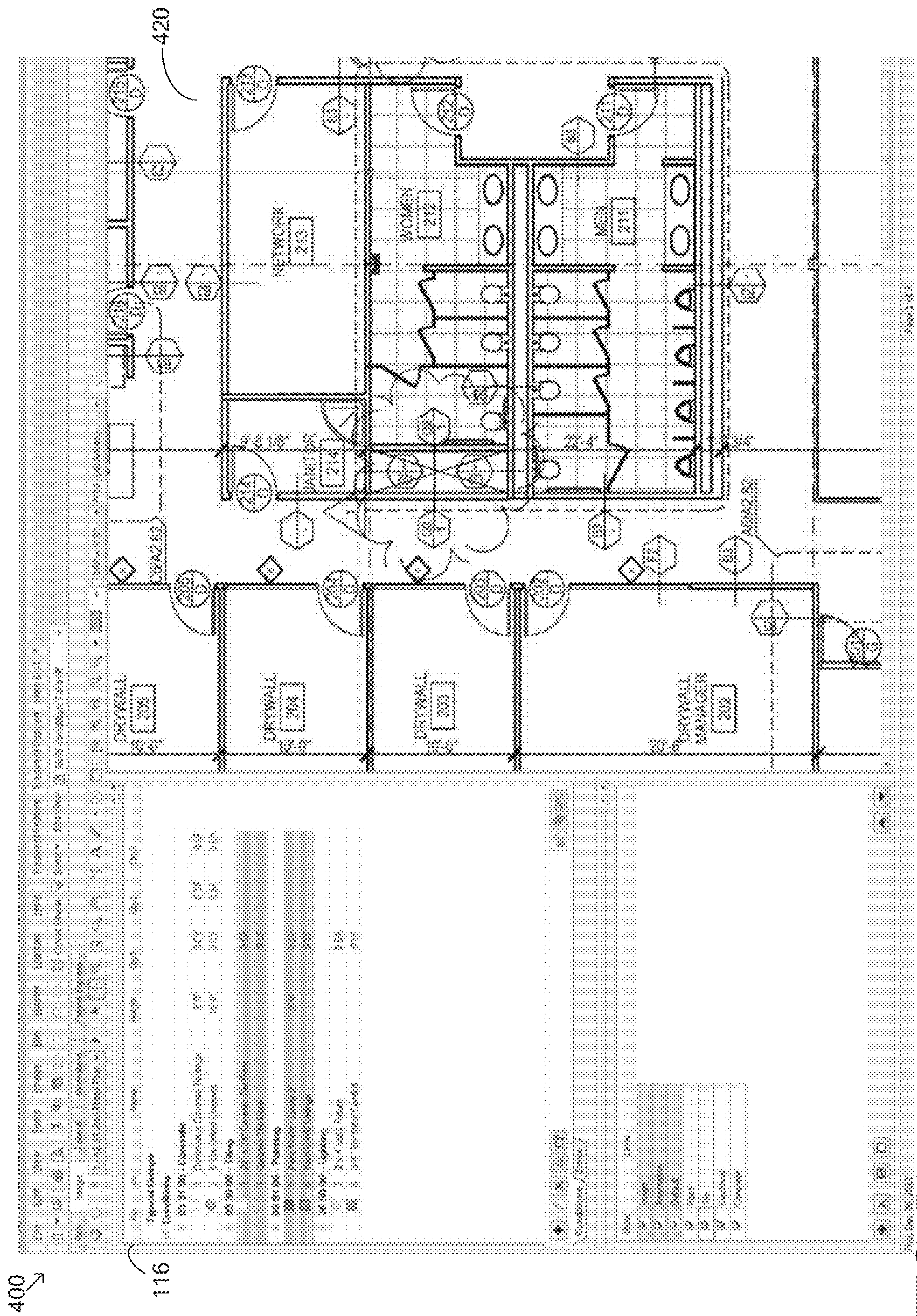


FIG. 5A

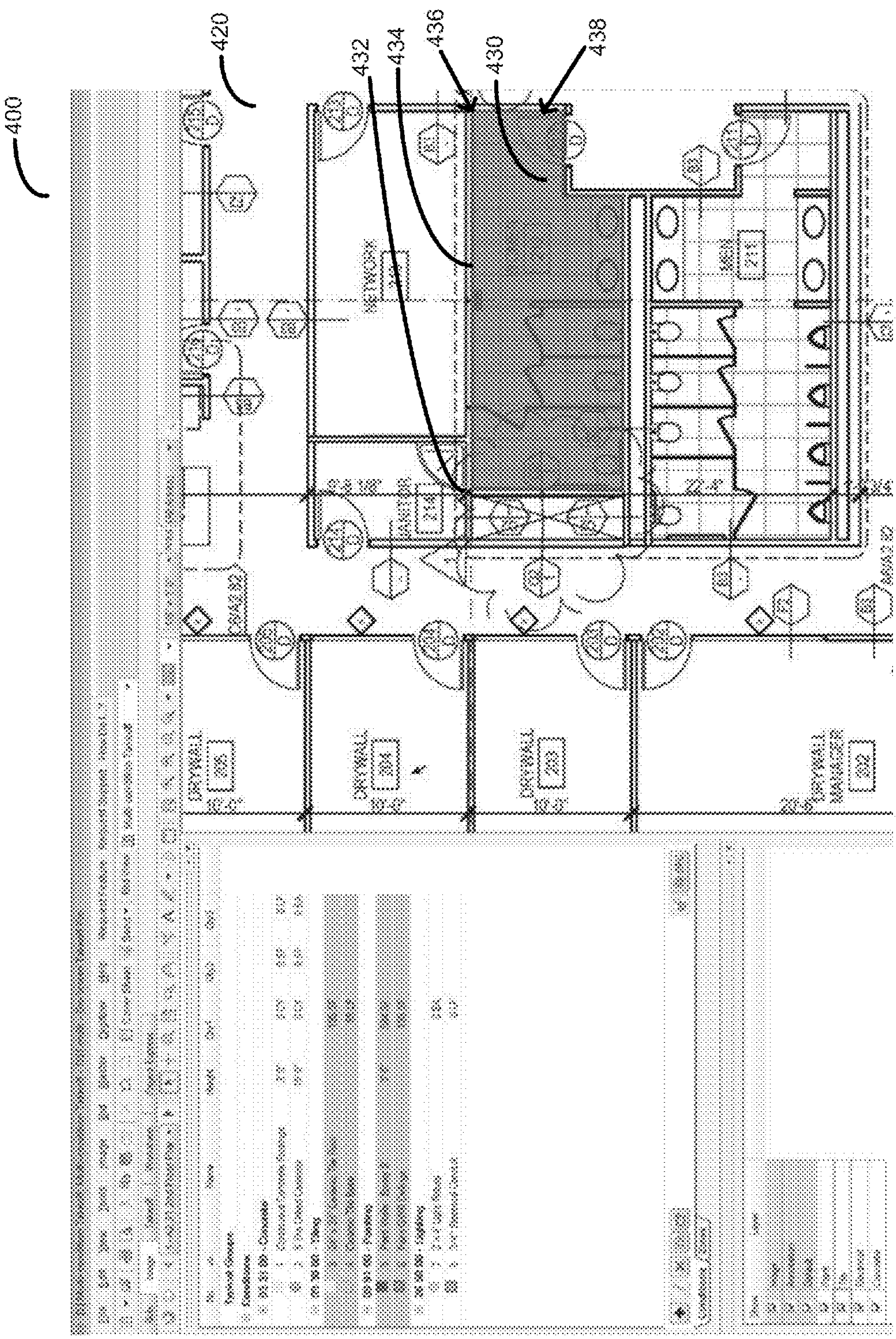


FIG. 5B

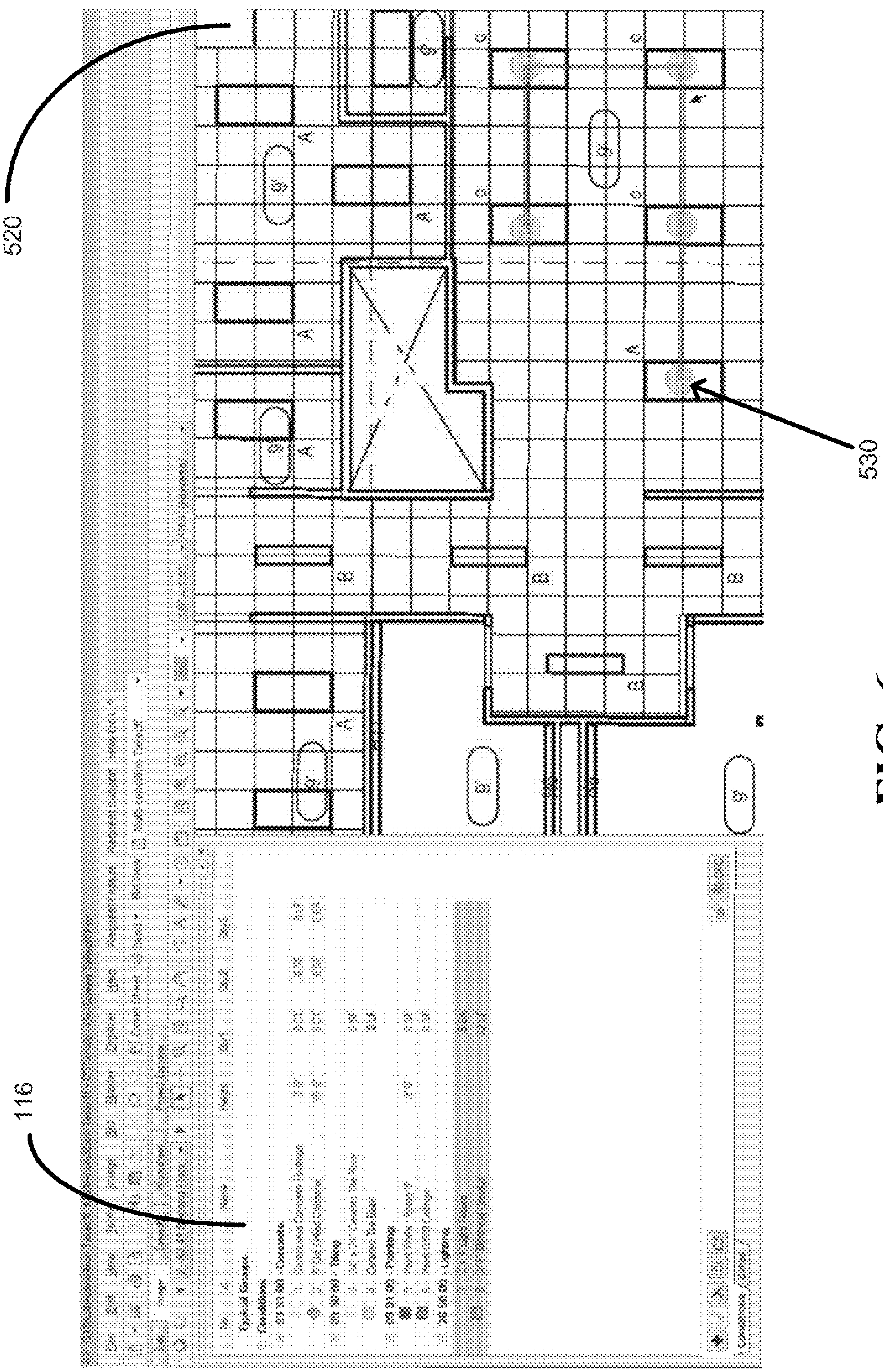


FIG. 6

MULTI CONDITION TAKEOFF IN CONSTRUCTION PROJECT SOFTWARE PROGRAMS

TECHNICAL FIELD

The present invention relates to management of construction projects, and in particular to techniques for increased efficiency of construction project software programs.

BACKGROUND

Construction professionals generally use computer software programs to provide pricing for large construction projects. Some of these construction software programs include capabilities for drawing or uploading construction plans and/or engineering drawings. The software programs may enable a user to enter a list of building conditions that are required to be completed for a given construction project. The term building condition refers to each separate component of the construction project that needs to be built or installed. For example, the ceiling, exterior structure, doors, or a particular type of wall are all considered building conditions. In order to price a project correctly, an efficient method of calculating and tracking the quantities associated with each building condition may be needed. One way of achieving that is by creating live objects on a construction drawing for each building condition. As building conditions are entered, a user can create live objects on the construction drawings, where the live objects are linked to and represent particular building conditions. This process is sometimes referred to as takeoff. Once takeoff of building conditions is complete, the resulting software file would quantify building conditions and could be used to calculate a projected cost for the entire project and thus help create a bid for it. Such a file can also be used to track and manage the project once a bid is accepted and work on the project begins.

Accordingly, takeoff of building conditions in a construction project software program assists in automating unit and cost calculations and facilitates using such a program for keeping track of change and progress in the project. However, the process of takeoff itself can be very time consuming. That is because each area of a construction project requires completion of many different building conditions. For example, a bedroom needs a ceiling, electrical wiring, light fixtures, drywall, paint, flooring, a door, windows, and more. These building conditions need to be quantified individually and the process has to be repeated for each room or area of the construction project separately. In large construction projects involving many different building areas this means quantifying building conditions hundreds if not thousands of times. This can become a very time consuming and tedious process.

Thus, it would be desirable to implement a more efficient method for performing takeoff in a construction project software program.

SUMMARY

A method and system for simultaneously performing takeoff of multiple building conditions in a construction project software program is disclosed. The method comprises selecting two or more building conditions and moving a pointer to the construction drawing to select an area of the drawing on which to perform takeoff of the multiple building conditions. Once the area has been selected, the method and system creates one or more live objects on the selected area for each of the selected building conditions and simultaneously quantifies each of the selected building conditions based on the size of the selected area. The live objects include visual markers for each of the building conditions that are linked to their corresponding building condition.

BRIEF DESCRIPTIONS OF THE DRAWINGS

FIG. **1** is a diagram illustrating an exemplary user interface screen for a construction software program showing a construction drawing and its related information.

FIGS. **2**A-**2**B are diagrams illustrating exemplary user interface screens for a construction software program showing properties for a building condition in the construction drawing.

FIGS. **2**C-**2**E are diagrams illustrating options for snapping an area condition to a linear object.

FIG. **3** is a diagram illustrating an exemplary user interface screen for the construction software program providing cost information for building conditions in the drawing.

FIGS. **4**A-**4**B are diagrams illustrating exemplary ways in which an area condition snaps to a linear object.

FIGS. **5**A-**5**B are diagrams illustrating exemplary user interface screens having a multi condition takeoff capability.

FIG. **6** is a diagram illustrating an exemplary takeoff of multiple building conditions one of which is quantified by count.

DETAILED DESCRIPTIONS

FIG. **1** illustrates an exemplary user interface screen **100** used in a construction project software. Generally, a first step in using this software program is to create or upload one or more engineering or construction drawings into the program. Construction drawings for each project generally include a representation for each of the various building conditions in the project.

The user interface screen **100** includes several buttons, tabs and drop down menus that provide a variety of options for viewing and processing of construction related information. For example, the screen **100** includes a tab **106** for choosing to view the Bids, a tab **108** to view the Image, a tab no for viewing quantity totals in Takeoff, a tab **112** to view an estimating Worksheet, and a tab **114** to view Project Express for sending and receiving bids. When selected, the Image tab **108** provides a view of a construction drawing, such as the construction drawing **120**. A dropdown menu **104** allows the user to select which page or area of the construction project to view. The selected area can be any part of the construction project for which a separate construction drawing exists. For example, the dropdown menu **104** in screen **100** shows that the 2nd Floor Plan has been selected. As such the corresponding drawing **120** includes all the various building conditions in the 2nd Floor area of this construction project. Before takeoff is performed, the drawing **120** by itself is just a two dimensional drawing and does not include any objects that have underlying values. Objects are created on the drawing during the takeoff process.

The takeoff process involves counting or quantifying all building conditions for the project and is performed by estimators in construction projects to determine an estimated cost for the project. For example, for the building condition of interior doors, all required interior doors are counted. In the construction project software of the preferred embodiment, this process can be performed by selecting a building condition from the conditions list **116** and clicking on (or otherwise selecting) places and/or areas on the drawing **120** where the selected building condition is to be located. By doing so, an object that corresponds to the selected building condition is placed on the drawing. An object is generally represented by a colored line or shape, depending on the type of the building condition, and is linked to the building condition represented by the object. For building conditions that are counted by their quantity, such as doors and windows, merely clicking on a spot on the drawing creates a colored representation of that condition and adds one to the total counted quantity for that building condition. An example is the door **102** shown in the drawing **120**. By selecting door as a building condition in the conditions list **116** (not shown) and clicking on a spot on the drawing where a door needs to be placed, an object **102** is created. The object **102** is a live object, meaning that it recognizes that it represents the "door" building condition on the 2^{nd} floor, and it increases the total quantity of the count for doors by one.

For objects, such as walls that are quantified by their length, a line is usually drawn on the drawing to create a corresponding object. An example is the wall **103** on the drawing **120**. Based on the length of the line drawn, the software automatically increases the quantity being measured for the building condition associated with the object. In this manner, the takeoff process achieves two objectives. One is quantifying the building conditions in the project, and the other is creating live objects that have underlying values and are linked to corresponding building conditions.

The two dimensional image shown in the drawing **120** can also be three dimensional (3D) such as a 3D CAD drawing, Building Information Model (BIM), or the like. A 3D drawing is advantageous in that the user can view each of the various building areas in a manner that is closer to the actual shape and design of the buildings and can examine each object easier. Some 3D models also include objects that have built-in associated quantities. The quantities can include the size of the object and may also include associated labor activities and materials required to complete it.

Referring back to the user interface screen **100** of FIG. **1**, the screen allows the user to click on each object in the drawing **120** to select the associated building condition. For example, the user can click on and select a particular type of wall, such as the "F2 Walls@9'" wall **103** selected in FIG. **1**. When selected, that building condition becomes highlighted in the conditions list **116**. The conditions list **116** also displays a list of names **118** for building conditions **124** and a corresponding column Qty1 **122** showing the associated total quantity for each building condition. The column Qty1 **122** represents the quantity associated with each building condition in the drawing **120** in an appropriate unit of measurement.

Double clicking on or otherwise selecting a building condition in the conditions list **116** brings up a window for setting properties of that building condition. For example, double clicking on F2 Walls @ **9'** in the conditions list **116**, brings up the properties window **200** of FIG. **2**A. The window **200** can also be presented for creating a new building condition.

The condition properties window **200** includes entries for style **210** and name **220**. The style **210** enables the user to select the type of object that will be placed on the drawing when this particular building condition is selected. "Linear" is used for building conditions such as walls that are shown by lines; "each" is used for building conditions such as doors and frames, and "area" is used for building conditions such as tiles that cover an area and are represented on the drawing by coloring or shading the area that corresponds to that building condition. The name **220** allows the user to change or select a name for the building condition. Entries for dimension **230** allow the user to select height, thickness and slope for the object representing the building condition on the drawing and entries for Appearance **240** enable the user to select a color and pattern for that object. The results **250** includes three dropdown boxes to choose up to three units of measurements for quantities associated with the building condition. Linear feet is used for measuring length, while square feet is used for surface area and each is used for segment count. Other options are also presented in window **200**. Once all changes have been made to the desired properties, the user is taken back to the user interface **100** of FIG. **1** by selecting the OK button **250** of FIG. **2**A.

FIG. **2**B illustrates a view of the conditions properties window **200** with the Advanced tab **260** selected. The advanced tab allows the user to select advanced properties for the building condition. These properties include the option to round the measurement quantity of the building condition and to choose to display the pattern while the building condition is being drawn on the drawing. The properties also include the option for area building conditions, to choose how to snap to a linear object on the drawing. For example, the user can select to snap to the inner, center or outer edge of a surrounding linear object. This is illustrated in FIGS. **2**C-**2**E.

FIG. **2**C shows how an area object snaps to the inner edge of a linear object, when snap to the inner edge is selected as the object. FIG. **2**D illustrates how the area snaps to the center of the object and FIG. **2**E shows how it snaps to the outer edge of the object. As can be seen, depending on the option selected, both the way the object linked to the building condition is shown on the drawing and the size of the area measured for the building condition during the takeoff process will be different for each of the selected options.

Once all building conditions have been created and takeoff has been performed, in one embodiment, the quantity information gathered through the takeoff process is used to create a cost estimate for the project. In the preferred embodiment of the present invention, this is done by using a worksheet integrated into the construction project software represented in FIG. **1**. Clicking on the Worksheet tab **112** of FIG. **1**, takes the user to the estimating Worksheet screen **300** of FIG. **3**.

The Worksheet screen **300** includes a column **310** that lists the name of the various building conditions and columns **312**, **314** and **316** that list the associated quantities measured for each of the named building conditions. The screen **300** also includes a column **318** for listing the cost of material associated with each building condition, a column **320** for listing the cost of labor for each building condition, a column **322** which displays a subtotal for the costs associated with each building condition and a column **324** that displays the total cost for each building condition. After quantity and cost information for building conditions in a project has been entered, the software program can calculate a total estimated cost for the construction project.

In an alternative embodiment, a separate software program designed for estimating construction projects, such as Quick Bid®, provided by On Center Software™, Inc. is used to calculate the estimated costs associated with a project. When a separate estimating program is used, a file is created in the estimating program containing detailed cost information for each building condition in the construction project file presented in FIG. **1**. This estimating file is linked to the file represented in the interface screen **100**.

Although the information gathered and the links created through the takeoff process is very useful in increasing efficiency of the bidding process and management of construction projects, the takeoff process itself can be time consuming and burdensome in large and complex projects. That is because each area or room of a construction project requires the completion of multiple building conditions, and current construction project software programs require that live objects for each building condition be individually created and quantified for each area of the construction project. This can take a lot of time in large construction projects.

The preferred embodiment of the present invention provides a method for performing the quantity takeoff process for multiple conditions at the same time and thus significantly reduces the amount of time and effort required for takeoff. Prior art construction project software programs require takeoff to be performed one by one for each building condition, because of the complexity of creating multiple live objects and making multiple quantity measurements at the same time. The process of takeoff is complex because in addition to automatically performing quantity measurements and creating live objects, the process also creates a visual marker for representing the building condition on the construction drawing. For example, as discussed before, the wall **103** of FIG. **1** is represented by a line.

Visual properties of the visual marker can be selected in the building condition properties window (screen **200** of FIG. **2**) and include color and dimensions. For a linear object such as a line those visual properties include color and thickness of the line. For an object that encompasses an area, such as ceiling, the visual properties include color, pattern and thickness of the line surrounding the area. Generally each building condition has distinct visual properties that help identify it separately on the construction drawing. Thus takeoff not only includes quantity measurement and linking of a visual marker to the building condition, it also includes creating a visual marker with distinct visual properties. Thus, for takeoff of multiple conditions at the same time, the software needs to determine how and if the various visual markers can be shown at the same time.

The present invention provides a way to integrate many different business and mathematical rules into the software to enable takeoff of multiple conditions at the same time. This is done by checking a rules database once multiple conditions that include different types of units of measurements are selected. The rules database helps determine how to display the objects on the drawing and how to measure the quantities associated with each condition. For example, the rules database provides that for building conditions that include both linear and area units of measurement, area snaps to the linear that proceeded it in the order the user selected the building conditions. An example is illustrated in FIGS. **4**A-**4**B.

If the user selects multiple conditions in the following order: 1) building condition A with a linear unit of measurement and an area that is supposed to snap to the inner edge, and 2) building condition B that includes a linear and an area that is supposed to snap to the center, the area for the object representing building condition A would snap to the inner edge of the linear object A (as shown in FIG. **4**A) and area B would snap to the center edge of the linear object B (as shown in FIG. **4**B).

In an alternative embodiment, the rules database provides that all area takeoff objects that are created snap to the middle of the linear objects used in that step of the process, regardless of what option is selected in FIG. **2**B for snapping to the objects.

The rules database also sets the order in which objects are drawn on the drawing. The order depends on the types of units of measurements involved for the building conditions selected. In one embodiment, when building conditions that include both linear and count types of measurement units are selected, the objects are drawn in the following order: 1) linear objects, 2) count objects. The count objects would be drawn at each point the user clicks (or otherwise indicates a selection) on the drawing with one exception. The last double click to end the takeoff process will be only counted as one click for the count object. If the user does not intend to include a count at the ending location, the user can press the space bar instead of double clicking in which case the ending location will not be counted.

When the building conditions selected include both area and count, in one embodiment, the rules provide that area is drawn first and count is drawn at each point user clicks on the drawing with the following exception. The last double click to end the takeoff process will be only counted as one click for the count object. If the user ends the process by pressing the space bar instead of double clicking, the space bar is treated as a single mouse click for the count object. When the building conditions selected include area, linear and count measurement units, in one embodiment, the rules provide that the objects would be drawn in the following order: linear, area, and then count.

FIG. **5**A illustrates a user interface screen in which four different conditions have been selected at the same time. This is done, in one embodiment, by first selecting a building condition in the conditions list **116** and then holding the control key down and clicking on additional building conditions to select them. In the screen **400** of FIG. **5**A, four building conditions have been selected. These include 24"×24" Ceramic Tile Floor, Ceramic Tile Base, Paint Walls—Epoxy 9', and Paint GWB Ceilings. Because these four building conditions cover the same surface area for a bathroom, takeoff can be performed for them at the same time. As can be seen in FIG. **5**A, when the building conditions are first selected, their corresponding quantities are all zero. Once they have been selected, the user can move the computer pointer to the drawing **420** to select an area for takeoff of these building conditions. This is illustrated in FIG. **5**B.

To select an area such as area **430** for takeoff of multiple building conditions, the user can click on a first corner of the area such as the corner **432**. Because the software recognizes that at least one of the selected building conditions involves a linear or area unit of quantity, clicking on a spot generates a line that can be dragged to a second spot on the drawing. Once the user has dragged the line to a second corner of the area that is being selected, the user can click again to indicate that spot as a corner. This enables the user to change the direction of the line. For example, once the line **434** has been dragged to the corner **436**, clicking on the corner **436** allows the user to change the direction of the line from horizontal to vertical to generate the line **438**. By clicking on the corners of the selected area and changing the direction of the line, the user can select a desired area for takeoff. To complete the area, the user can drag the line back to the starting point and double click on the corner **432** to indicate that the selection has been made. Alternative embodiments for selection of an area for takeoff are also possible. For example, the user may be able to click on a corner to select a starting point for the area and then the drag the pointer to select an entire area.

Once an area has been selected, the program checks the rules database to determine how to perform the takeoff simultaneously for the multiple conditions. The rules database determines in what order objects are drawn on the drawing and also what linear object area objects snap to. The program automatically creates visual markers for each of the selected building conditions on the drawing, while at the same time calculating a quantity measurement for each of the building conditions based on the dimensions of the selected area. For example, as shown in FIG. **5**B, the program can calculate that the linear length of the perimeter of area **430** is 65 LF and thus assign this quantity to the building condition Ceramic Tile Base which requires a linear quantity for Qtr. The program also automatically detects that the floor and ceiling measurements for the same area are the same. Thus, calculated quantities for the building conditions 24"×24" Ceramic Tile Floor and Paint GWB Ceiling are the same 195 SF. For paint the program recognizes that height and surface area of the walls need to be taken into account instead of the surface of the area **430** as shown in FIG. **4**B. Although height is not shown in the drawing **420**, it is taken into account when it is included as a property for a building condition (shown in FIG. **2** under Dimension **230**). The software program of the preferred embodiment of the present invention identifies the underlying properties of each of the selected building conditions and takes those into account in both creating the visual markers on the drawing and calculating quantities for takeoff.

FIG. **6** illustrates a situation in which one of the selected building conditions is a type that needs to be measured by count and the other building condition should be quantified by linear feet. The building conditions selected in FIG. **6** are light fixtures and the electrical conduit connecting the light fixtures. Once the user has selected these two building conditions in the conditions list **116**, the pointer can be moved to the drawing **520** for takeoff. Generally, count objects are created each time the user clicks on a spot on the drawing. Thus, to takeoff both building conditions, the user can begin by clicking on the spot **530** on the drawing **520**. If takeoff included only building conditions that are quantified by count, then each click would create one object. However, because the takeoff shown in FIG. **6** includes both count and linear building conditions, clicking on the spot **530** creates one live object for the light fixture and also generates a line that can be moved across the drawing to create an object for electrical conduit. Both building conditions can be created simultaneously by clicking on spots on the drawing where a light fixture should be placed, while moving to the second count point and clicking the mouse again to generate a linear object for the electrical conduit. Alternative methods of using the pointer to create live objects are contemplated. Once the selection has been made, count and linear calculations are automatically made by the software and displayed in the conditions list **116**.

This construction software program allows construction professionals to create multiple live objects on a construction drawing at the same time and simultaneously quantify multiple building conditions associated with those live objects. This system of performing multiple building condition takeoffs at the same time significantly increases efficiency of the bidding process and reduces the time required for takeoff.

As would be known to a person of ordinary skill in the art, the software program of the preferred embodiment of the present invention is generally stored in a non-transitory computer medium such as memory in a computer device and is run by a processor inside that computer. This processor can be located in a computer in an office, in a local or remote server, or in a network cloud.

It is to be understood that the above description is intended to be illustrative, and not restrictive. For example, it is understood that the term clicking and dragging are used as exemplary methods of selecting an object or an area. All other methods of selecting an object or area on a screen are contemplated, e.g., tapping, and the like. For example, the above-described embodiments may be used in combination with each other. Many other embodiments will be apparent to those of skill in the art upon reviewing the above description. The scope of the invention therefore should be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled. In the appended claims, the terms "including" and "in which" are used as the plain-English equivalents of the respective terms "comprising" and "wherein."

What is claimed is:

1. A computer-implemented method of modifying a data file associated with a construction project, the method comprising:

displaying, on a display device, a construction drawing accessed from the data file;

receiving, via a user interface presented via the display device, a first user selection of two or more of multiple building conditions that are each quantifiable by using discrete units of measurement, linear units of measurement, or area units of measurement;

receiving, via the user interface, a second user selection of locations on the construction drawing at which live objects are to be created;

simultaneously creating the live objects to represent each of the selected building conditions on the construction drawing;

displaying, on the display device, one or more of the live objects for each of the selected building conditions for the selected locations on the construction drawing;

identifying, using a rules database, a rule for quantifying a first one of the selected building conditions and a second one of the selected building conditions at the same time;

automatically quantifying, using the identified rule, the selected building conditions at the same time; and

modifying the data file to include, in quantity totals for the multiple building conditions with respect to the construction project, the quantity of each of the selected building conditions.

2. The method of claim **1**, further comprising linking each of the created live objects to an associated building condition.

3. The method of claim **1**, wherein the rules database defines an order in which the live objects are created on the construction drawing.

4. The method of claim **1**, wherein the first one of the selected building conditions is quantified by using a linear unit of measurement.

5. The method of claim **1**, wherein the first one of the selected building conditions is quantified by using a discrete unit of measurement.

6. The method of claim **5**, wherein after receiving the first user selection, a live object is created for the selected building conditions in response to receiving the second user selection of the locations on the construction drawing.

7. The method of claim **1**, wherein the first one of the selected building conditions is quantified by using area as the unit of measurement.

8. The method of claim **1**, further comprising receiving a third user selection of one or more properties for one or more of the selected building conditions.

9. The method of claim **1**, wherein the live objects comprise visual markers.

10. A non-transitory computer medium comprising software that causes a processor to:

display, on a display device, a construction drawing accessed from a data file associated with a construction project;

receive, via a user interface presented via the display device, a first user selection of two or more of multiple building conditions that are each quantifiable by using discrete units of measurement, linear units of measurement, or area units of measurement;

receive, via the user interface, a second user selection of locations on the construction drawing at which live objects are to be created;

simultaneously create the live objects to represent each of the selected building conditions on the construction drawing;

display, on the display device, one or more of the live objects for each of the selected building conditions for the selected locations on the construction drawing;

identify, using a rules database, a rule for quantifying a first one of the selected building conditions and a second one of the selected building conditions;

automatically quantify, using the identified rule, the selected building conditions at the same time; and

modify the data file to include, in quantity totals for the multiple building conditions with respect to the construction project, the quantity of each of the selected building conditions.

11. The non-transitory computer medium of claim **10**, wherein the software further causes the processor to link each of the created live objects to an associated building condition.

12. The non-transitory computer medium of claim **10**, wherein the rules database defines an order in which the live objects are created on the construction drawing.

13. The non-transitory computer medium of claim **10**, wherein the first one of the selected building conditions is quantified using a linear unit of measurement.

14. The non-transitory computer medium of claim **10**, wherein the first one of the selected building conditions is quantified by using a discrete unit of measurement.

15. The non-transitory computer medium of claim **14**, wherein after receiving the first user selection, the software further causes the processor to create a live object for the selected building conditions in response to receiving the second user selection of the locations on the construction drawing.

16. The non-transitory computer medium of claim **10**, wherein the first one of the selected building conditions is quantified by using area as the unit of measurement.

17. The non-transitory computer medium of claim **10**, wherein the software further causes the processor to receive a third user selection of properties for one or more of the selected building conditions.

18. The non-transitory computer medium of claim **10**, wherein the live objects comprise visual markers.

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